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A HEALTH INDEX FOR ONTARIO

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I. Introduction

This report is presented in six sections:

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A health index is a number generated by a formula, designed to reflect the level of health of a given population. It is an index in the sense that the result of an application of this formula to different sets of data is an ordered set of numbers indicating the health of the population.

It should be noted that an index is not an absolute measure but a representation. For example, the volume of shares traded on the stock market is a simple measure or count, whereas the level of the Dow Jones is an index of the price of shares on the New York Stock Exchange. Two things are noteworthy in the construction of such indicators. First, there is always a system of weights applied to the individual items counted in constructing the index. (In the construction of the Consumer Price Index, for example, each one of the goods and services included in the representative "basket" is weighted by its respective price

during the period under consideration.) Second, the number of items in the whole population that are included in the construction of the index is an important determinant of its quality as a representation of the true world. For this reason, the New York Stock Exchange Index would be more representative of the average price per share than would the Dow Jones, since the latter includes only thirty share prices while the former includes the entire population of share prices on the New York Exchange. There is a third criterion of importance in judging an index, namely, the accuracy of the data on the included items. This factor has particular relevance in the evaluation of the health index under consideration.

II. Reasons for Constructing a Health Index

There are two major reasons for attempting the construction of an index of health; first, the desire to generate social indicators and second, the necessity of organizing the allocation of government resources in this sector on a cost-effectiveness or Program Planning Budgeting System basis. In addition there is, of course, the need for a greater understanding of how the health sector actually functions and of government's role in it.

(i) Health Index as a Social Indicator

The first rationale for the construction of a health index is to provide one of a larger set of social indicators or indices. These would reflect the social performance of a community in a manner analogous to the reflection of economic performance provided by economic indicators such as GNP, rate of inflation and rate of unemployment, to mention but three. For obvious reasons, indications of social performance are most anxiously sought in those areas of heavy government financial involvement, namely, health, education and welfare.

Apart from the applicability of social indicators to P.P.B.S., these indices are useful, in themselves, in spotlighting areas of social concern through both time series and cross-sectional analyses. By quantifying performance in these areas, it can be determined whether the community is doing better or worse,

along any particular dimension, either time or space. Deterioration over time or significant differences across regions might well indicate the necessity for formulating new policies and plans. In general, social indicators constitute an information or monitoring system in areas of vital community concern.

(ii) Health Index in Planning Models

It is not sufficient to know when a community is doing relatively well or poorly along any of these dimensions; the more compelling reason for the development of social indicators lies in their potential application to generalized planning models. It was in this context, with particular reference to the application of Program Planning and Budgetary Systems to the operation of the United States Department of Health, Education and Welfare, that, in 1966, Secretary Gardner began the development of social indicators for that country, and thus launched the first major attempt in this new area.

The natural applicability of social indicators to planning models results from the fact that all systematic models require a quantitative measure of performance in order to be functional. If performance cannot be measured, it is difficult to plan programs to optimize performance.

Program Planning and Budgeting Systems models usually take the form of one of two varieties, either cost-benefit or cost-effectiveness.

Cost-benefit models are those which try to maximize the difference (or in some case ratio) between benefits and costs accruing from a particular plan, both quantified in monetary terms. These models are naturally most easily applied to business problems, though they are also used in planning government activities such as transportation systems and resource development. In areas, however, where a substantial portion of the benefits of any plan occur in non-monetary form, the application of straight cost-benefit analysis gives, at best, incomplete and, at worst, totally misleading results. And it is precisely with this type of problem that this study is concerned.

In this case, the appropriate technique is cost-effectiveness analysis rather than cost-benefit analysis. In this kind of model, the costs and benefits are non-commensurate in that the former can be measured in monetary terms, but the latter only in terms of some index representing performance in the area. Thus, there is no possibility here, as there is in cost-benefit analysis, of determining that a particular plan is unambiguously worth doing. In cost-benefit analysis, whenever the discounted stream of benefits is greater than the discounted stream of costs, the project under consideration is worth undertaking.

This is not to say that it is the best project available, but that in the absence of alternatives, the project should be approved, that there would be a clear positive return measured in money terms. Cost-benefit analysis can also be used, of course, to rank alternative projects according to their monetary returns.

Cost-effectiveness analysis, on the other hand, cannot determine unambiguously whether a project is worthwhile or not, since the costs and returns are not measured in the same terms, and thus no net benefit can be calculated in terms of a single reference unit. Cost-effectiveness analysis is useful, therefore, only in choosing between competing projects and in ranking alternatives according to the unit cost of output or output per dollar of input. However, it can determine, given a total budget constraint, which projects to select, and their order of priority. This, in itself, is no mean contribution, and thus the necessity for constructing social indicators for use in cost-effectiveness models is apparent.

In the particular case of health sector analysis, given a budget constraint of total government expenditure on health, a cost-effectiveness planning model could be constructed to select an optimal set of projects if, and only if, a health index, or some alternative performance measure, is available with which to evaluate the contributions of each project. A health index would presumably be the most appropriate output measure since here

the ultimate goal of government expenditures in this area is improvement in the level of health of the population.

A health index is therefore valuable both in its role as a social indicator and as an essential ingredient in a cost-effectiveness planning model of government expenditures on health.

III. Existing Health Indices

This section surveys briefly the existing literature in the field and touches on the basic nature and inadequacies of the existing approaches. For a more complete survey, the reader is referred to George Torrance's analysis of the literature.(2)

Although recently there have been calls for the development of an index of positive health, the indices surveyed and indeed the index finally constructed here are in fact representatives of the level of ill-health in the population. With the data currently available, it is impossible to measure anything but deviations from a healthy condition in one form or another.

Thus far, attempts to construct health indices have taken one of two general formulations. The earlier and cruder indices were simply mortality rates of various kinds. The level of health of a population was represented by proportional mortality above a certain age, by life expectancy statistics for various ages, by infant mortality statistics, or by the crude death rates. These measures, however, tell nothing about the health of the living. As mortality rates stabilize, as they have done in recent years in Western countries, these measures become increasingly non-operational as indicators of change in the level of health of the population.

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(2) Torrance, J.W.: A Generalized Cost-Effectiveness Model for the Evaluation of Health Programs - Chapter I, Research Series: No. 101, Faculty of Business, McMaster University.

More recently, researchers have rejected the traditional mortality-based indices in favour of functional-level indices of one type or another. These take many forms; in some cases only two levels of functional activity are considered, healthy and unhealthy. In others, there are several different disability or disfunction states considered, such as home confinement, hospital confinement, and out-patient status. However, the number of states considered rarely exceeds a dozen.

There are a number of drawbacks to these approaches. First, even in the most refined of these indices, there is little attempt to accommodate different disease categories. A day in hospital counts the same in these indices whether the patient is suffering from appendicitis or cancer. The "health" of the patient is clearly not the same in these two cases. Second, the weights used to aggregate the number of cases in each state into a single index number are determined in a completely arbitrary manner. In most cases, the researcher simply stipulates that a day in hospital is, for example, three times as serious as a day during which the patient visits an outpatient clinic. This arbitrary assignment of weights by each individual researcher certainly damages the general applicability of these approaches to government decision-making.

There is also a critical practical difficulty in applying a functional approach to health index construction; there exist no adequate data on the number of cases in each functional state, if more than two or three general functional descriptions are to be used, i.e. dead or alive, in or out of hospital, out-patient or not. For all these reasons, it was decided that the existing approaches to health index construction were inadequate for our purposes.

IV. The Model

The objective in creating a health index is to construct the most complete and accurate representation of the health of the population as possible, within the primary constraint of data availability. In effect, this means devising an optimal index and then adjusting down to a feasible one, recognizing the practical constraints which present themselves.

To begin with, the health of a population can be broken down into two main components: physical and mental. For the purposes of this study, attention was restricted to physical health. The problems of measuring mental health are, needless to say, even more complicated. Even within the sphere of physical health, however, it is clear that health is not a uni-dimensional characteristic and thus, a good representative index should also be multi-dimensional. In particular, it seemed that at least four major "dimensions" recommended themselves for consideration: fatality, pain, disability and social effects; the last category representing such consequences of ill health as social isolation, disfigurement, family disruption, and so on.

Theoretically, in order to construct a comprehensive index, it is necessary to measure a population's status in each of these categories, and then aggregate them into a single number. This

objective was abandoned for several reasons. Firstly, the problems of collecting data on the pain, disability and social effects dimensions were insurmountable with the time and resources available. Secondly, the problem of interrelating and aggregating the four dimensions seemed equally perplexing. There remained the possibility of opting for an index incorporating the only feasible dimension of the four listed, namely fatality. This, however, would simply result in the construction of a more sophisticated mortality index, with the attendant problems mentioned above.

It was decided to follow an alternative route. Since no explicit formulation of a multi-dimensional index was possible, a second-best, implicit approach seemed appropriate. Accordingly, the model of the health index constructed is based on the enumeration and valuation of disease states. Each disease category is characterized by a certain range of probable fatality, pain, disability and social effect conditions. Thus, by evaluating the seriousness of each particular disease category, we implicitly measure the probable levels of the other four dimensions. It is no doubt true that this implicit approach is only a proxy for the more comprehensive multi-dimensional index, and perhaps not a very accurate one. Nevertheless, it is not only the most appealing alternative theoretically, but the exigencies of data

collection point clearly in this direction; for the available data on the number of individuals in each disease state are, if not pure, far more accurate and complete than exist for any other feasible dimension.

Once it had been decided which incidence statistics to use, there remained the problem of aggregating these data into a single index number. What this boils down to is the problem of generating weights for each disease state counted in the index formula. To give a concrete example, suppose there were only two disease states incorporated in a health index, cancer and chicken pox. Once the number of cases of each state in the population had been counted, it would still be necessary to know how much to "weigh" each case of cancer relative to each case of chicken pox, in order to be able to aggregate the data into a single number. Suppose that in a population of 1,000,000, there were 25 cases of cancer and 2,500 cases of chicken pox. Suppose further that it has been decided that each case of cancer is to count ten times as heavily as a case of chicken pox. In such a situation, the index could be constructed as follows: (10 x number of cancer cases + 1 x number of chicken pox cases)/Population. This would yield an index number of .00275. If, given the same data, it had been determined that each case of cancer would count a thousand times as heavily as each case of chicken pox,

the resulting index number would be .0275. In the former case, chicken pox would appear as the dominant contributor to ill health; in the latter, cancer would dominate. It is clear that the choice of weights is of paramount significance in the generation of a health index and cannot be left to arbitrary determination.

In selecting the weights for an index where the relative importance of the various included states is represented by a subjective evaluation, it is necessary to consider the purpose to which the index will ultimately be applied. That is to say, the user has to accept the validity of the subjective weights. In this case, the health index was being designed in order to assist government planners in allocating resources in the health sector. It seemed appropriate, therefore, that the planners' preferences ought to count. In other words, their assessment of the relative importance of each disease state ought to be reflected in the weights used to aggregate the disease incidence statistics.

V. The Data

The key to the construction of any index is the gathering of complete and reliable data. The model used to design the health index was therefore constructed so as to avoid violating any of the anticipated data constraints. For that reason, it was decided to measure health along the disease state dimension as opposed to the four other considered categories. In this case, theoretical elegance was sacrificed for data availability. There were two major kinds of data used in this project; data on the incidence of the disease states, and data on the weights used to aggregate these incidence statistics. The collection of the first kind of data was fairly straightforward.

The Incidence of Disease

In conjunction with its remuneration of physicians, O.H.I.P. collects information on the incidence of various diseases in specified diagnostic codes. In particular, the International Classification of Diseases codes used by the World Health Organization, numbering over a thousand, were condensed and consolidated into some 259 disease categories. Whenever a physician treats a patient, or rather, whenever he bills O.H.I.P. for that service(no divergence is assumed here), he is obliged to include on the billing form the diagnostic code appropriate to the medical condition of the patient. The tabulation of these diagnostic code statistics is the primary source of the incidence data.

There are difficulties with these diagnostic code data. Principal among these is the fact that the diagnostic statistics in their raw form are certain to include double-counting from two sources. First, whenever a physician sees a patient more than once for the same disorder, it is recorded as a separate incident. Second, whenever the patient is seen by more than one physician for the same ailment, as is the case with referrals, the disease is again counted more than once.

These double-counting difficulties were dealt with in two separate ways. In order to remove the influence of referrals, only those cases treated by general practitioners were counted. This assumes, of course, that a general practitioner is involved at least once in the treatment of each disease state, and particularly in the case of hospital patients, this may be an erroneous assumption. Nevertheless, the error introduced here seems preferable to the multiple counting caused by referrals to specialists. To eliminate the effects of multiple visits to the same general practitioner for the same ailment, all incidents on the O.H.I.P. records for each patient in each month having the same diagnostic code as the original incident were removed from the data base. Only the first time in each month that a patient sought care for each ailment was counted. This does involve the removal from the incidence statistics of those

bona fide cases where, for example, an individual breaks his arm twice in one month, rather than gets treatment twice in the month for the same broken arm, but this error was thought to be quite insignificant.

A more serious source of error lies in the fact that the actual coding of the diagnosis is often erroneous. This is due to incorrect diagnoses, to the arbitrary coding of multiple diagnoses, and to the use of very general diagnostic categories when the physician cannot determine the particular nature of the patient's condition. Thus, categories such as "other diseases of upper respiratory tract", or "influenza" have extraordinarily large incidence statistics.

Finally, the diagnostic code data cannot accurately measure disease episodes but only disease states. In other words, if a patient comes in with a cold which develops into bronchitis, and then into some other respiratory ailment, the data system perceives this as multiple disease states whereas, in fact, it may only be a single disease "episode". There was no feasible way of correcting this kind of double counting and the data remain inaccurate in this respect.

All disease states for which no medical attention is sought do not, of course, get recorded in this data system. It is thought, however, that, given a near-zero price for physicians' services,

this error would be quite insignificant.

In summary, although the data finally used in the index construction were considerably "cleaner" than the raw statistics gathered by O.H.I.P., there remain serious deficiencies in accuracy. Nevertheless, this data source is the most comprehensive available and is adequate at least for the purposes of this first attempt at constructing a health index.

The Weighting System

The second set of data required was the weighting system used to aggregate the incidence statistics. Since these weights are by definition subjective evaluations, it is not possible to assess their accuracy in an objective sense, as can be done in the case of incidence statistics. Nevertheless, the process by which these weights are determined must elicit and incorporate the relevant opinions and preferences that the government planning process has to consider. To accomplish this end, an interview questionnaire was designed and a sample of respondents selected. The sample consisted of twenty general practitioners chosen from the Ministry of Health, from the Department of Family and Community Medicine at the University of Toronto,[3] and from the National

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(3) Dr. Fallis, Chairman of the Department, gave considerable assistance and advice, and his co-operation in giving permission to interview members of his Department was invaluable.

Research Register, a list of general practitioners compiled by the College of Family Physicians of Canada.[4] The sample was restricted to general practitioners since it was thought that specialists might be insufficiently exposed to all the diagnostic categories under consideration, and that the opinions and preferences of lay people were not sufficiently informed.

The questionnaires were designed so as to elicit a maximum number of responses in the feasible time limits. To this end, with assistance from Dr. Lang and Dr. Wigle of the Ministry of Health, 59 key disease states were selected from the 259 diagnostic code categories of O.H.I.P. These represented a broad spectrum of diseases with at least one in each of the nineteen general diagnostic groupings and a balance between acute and chronic, serious and mild, age/sex - specific and general; in short, diseases from whose weights it would be possible to extrapolate to the other almost 200 diagnostic categories not directly considered in the interviews. In addition, the description of each disease state selected was as specific as possible to facilitate evaluation during the interview.

There is, of course, a trade-off between the number of states evaluated and the number of times each state is evaluated by the respondents. It was decided that the twenty best benchmark states would each be evaluated ten times and the remaining thirty-nine

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(4) This list was previously provided by Dr. A. McFarlane of McMaster University Clinic.

states, five times each. Thus, twenty different questionnaires were constructed, each one containing ten of the key states and ten secondary states randomly ordered.

The respondent first received an explanation of the study in general. He was then asked to rank the twenty states on the questionnaire in order of preference, keeping in mind the following considerations: he was to view each state in question as being hypothetically contracted by him personally at that instant, and he was to consider not only the fatality aspect of the disease but the pain, disability, and social consequence aspects as well. He was asked to ignore all the costs of such a hypothetical disease.(5) In order to facilitate the ranking procedure, the respondent was asked to select the most preferred and least preferred state first, and then work in towards the middle. After the ordering was complete, the doctor was asked to survey the entire set of rankings and to change any that he wished.

At this point, the interviewers provided an explanation of the standard gamble technique. The physician was presented with the following options: suppose he, at that instant, contracted the first disease on the list with all its attendant consequences,

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(5) In the cost-effectiveness model, all financial considerations can be included on the cost side.

not only the fatality considerations. If, at that point, he had the choice between suffering that condition (and treating it by conventional means) or taking a hypothetical pill which would instantly remove the condition, but with a risk of death of probability p, which alternative would he choose. The probability p was then adjusted until the doctor was indifferent between the alternatives presented. The indifference points were recorded as the game was repeated for each of the twenty states on the list. After this had been completed, the doctor was again given the option of changing his mind about any of the indifference points.

Finally, a cross-check was conducted to ensure that the ordinal rankings done originally were consistent with a ranking of the indifference points. If contradictions appeared, the doctor was asked to resolve the problem by changing either the ordering or the indifference points. For example, if the doctor had originally decided that he would prefer to have diabetes to tuberculosis, but then indicated a willingness to chance a 10 per cent probability of death to get rid of the diabetes, but only a 5 per cent risk of death to rid himself of tuberculosis, this would present a contradiction, and the respondent would either have to raise the indifference point for tuberculosis, or lower it for diabetes, or change the original preference ordering. The interview was terminated when both sets of responses were complete and consistent.

Difficulties arose because of the nature of the states to be evaluated. Despite the attempts to select only specifically described diagnostic code categories, the nature of the O.H.I.P. breakdown is such that each state represents a myriad of different possible conditions. Tuberculosis, for example, is not a single precisely defined condition. The respondents, properly enough, wished to know exactly what kind of condition they were considering as an alternative to a risk of death. They were therefore asked to consider the entire range of conditions represented by the category name and treat the choice as one between a risk of death p and a specific condition chosen at random out of the probability distribution or range of conditions associated with the category heading.

Finally, to complicate matters even further, there were several disease states that were age-or-sex-specific, such as toxemia of pregnancy and hemolytic disease of the newborn. In these cases, the respondent was asked to stretch his imagination even further to envisage that the choice lay between that condition for his wife or child and a pill lottery with a probability of p of his own death and a probability of (1-p) of his wife's or child's cure. This strained the doctors' imagination and may have introduced some biases, but it appeared to be the best approach available.

One must conclude that, because of the problems inherent in this kind of preference determination, the final weightings for the 59 states considered cannot be accepted blindly as the appropriate government utility function coefficients. Nevertheless, it is hoped that the collection of at least five individual evaluations, and in some cases ten, helped smooth out individual idiosyncracies and the errors due to procedural problems.

Dr. Lang and Dr. Wigle assigned weights to the remaining O.H.I.P. diagnostic categories, using the weightings of the 59 disease states as benchmarks. In order to facilitate the assignment of weights, however, it was necessary to group several diagnostic codes together and the 259 O.H.I.P. diagnostic categories were reduced to 223.

VI. The Results

After the individual evaluations had been averaged out, and the extrapolations completed from these 59 benchmarks to the remaining 164 categories, the final index was constructed as the weighted sum of all the incidence statistics divided by the total population at risk. It should be mentioned that the number of states in this aggregation was actually 224 since death certainly must be added as the ultimate ill-health state. Each case of death is, of course, weighted as 1 by definition of the standard gamble game. Thus, the total number of deaths was added to the weighted sum of the other 223 incidence statistics, before dividing by the population at risk. The final calculated level of the health index was as follows:

$\sum b_i Y_i = 28{,}785.5$ (the Y_i were the incidence statistics for the month of October, 1970)

POP = 3,942,115

H.I. = .0073

Since index numbers are unitless, it is often hazardous to attempt interpretations of them except relative to other regions or other times. Nevertheless, one can possibly get some intuitive sense of what a .0073 level means by conceiving of it as the risk of death that the "average" individual would accept in order to rid himself of his ailments, if his preferences were identical to those generated by our study. There is no way of assessing

whether this number is big or small without calculating the size of the health index for other populations or other periods.

There are, however, several interesting features of the results that are worth mentioning. Table 1 in the Appendix presents the 59 risk-of-death weights for the disease states included in the survey. In addition, the standard deviations about these mean values are given, as well as the coefficient of variation, a statistic indicating the extent of variation about the means of the individual responses. For our sample, these variances are relatively large; in only two cases are the 95% confidence intervals (two standard deviations about the mean) less than 25% of the mean in either direction. In other words, in only two cases, leukemia and malignant neoplasm of the prostate, we are 95% sure that the true risk weight is the sample mean plus or minus 25%. We are even less certain of the representative accuracy of all the other sample means.

Following Table 1 is a set of calculations of the size of the sample required to get the confidence interval down to a $\pm 25\%$ band and a $\pm 10\%$ band at both the 90% and the 95% levels. These calculations were performed for three randomly chosen states and indicate that, for most disease states, the sample size would have to be considerably enlarged to get the confidence interval down to the designated ranges. (It should

be noted that since each respondent only considers one-third of the diseases, the sample of doctors required for each confidence interval is actually 3N.)

Table 2 in the Appendix presents a list of the 223 diagnostic code categories with their weights arranged in ascending order. These results are not only of interest in themselves, but can be of use in program selection, even without application of the index as a whole. If a decision has to be made between Program A and Program B, each addressing itself to different diseases, an evaluation of the benefits to be derived from each would be greatly facilitated by using the relative weights generated in our study. Thus, each case of glaucoma eliminated is worth .005 in health units, each case of strabismus .0015 units. If a choice has to be made between a glaucoma program and a strabismus program, an evaluation of the health benefits from each could be made by multiplying the anticipated reduction in incidence by the appropriate weight. The weights are therefore of great use in themselves, even in the absence of good diagnostic statistics with which to construct a health index.

Tables 3 and 4 in the Appendix list the disease states in order of their contribution to the health index, i.e. in order of the size of $b_i Y_i$. Several interesting phenomena appear. First,

heart disease dominates the index to a degree not altogether anticipated; "other forms of heart disease", "hypertension", and "other ischemic heart disease" together account for fully 49% of total ill-health. The first of these, however, "other forms of heart disease", is a melange of many different specific diseases, and the weight for this category was thus very difficult to determine. In view of the fact that this category has such a huge impact on the index as a whole, (over 25%), the inexactness of this particular weight is especially troublesome. In spite of this difficulty, it is still very clear that heart disease emerges as the dominant health problem. On the other hand, all forms of cancer combined contribute about 7%. Complications of pregnancy, congenital anomalies, and perinatal morbidity, make scarcely a dent, (less than .5%). Death itself contributed only 8% to the index, an indication that a mortality-based health index would indeed rest on a very narrow base.

for two reasons. First, as mentioned above, it is very difficult to interpret the meaning of an index except in a relative sense, and thus comparative studies must be done before an evaluation can be made of the significance of the level of the index that has been calculated. Second, the errors and biases that exist in the data are likely to be less important in a comparative context than they are in an absolute one, providing that the biases are consistent over time and space. Such an assumption is probably not unreasonable.

It is feasible and desirable, therefore, that the health index be regenerated periodically to provide a time series. Preliminary estimates indicate that each regeneration will cost approximately $2,000. Once a sufficient number of periodic evaluations are available, an analysis of the time series can proceed.

It is also possible that the index can be constructed on a cross-sectional basis. The best way of doing this would be to calculate the index level for geographical areas within the province.

Finally, as was mentioned above, the weights generated for use in the construction of the index can be used in the process of program selection within the health sector. Their use would allow the decision-maker to evaluate, in terms of health units,

VII. Conclusions and Recommendations

The overall conclusion to be drawn from this study is that, although there are pervasive inaccuracies in both kinds of data used, incidence statistics and risk weights, a useful health index can be generated. The results of the study can be applied in three general ways; the construction of other social indicators, further studies using the health index, and particular application to program selection in the health area.

The standard gamble technique for generating the index was successful, despite the attendant difficulties mentioned in the data section above. In this case, of course, consideration was given only to the health states. However, social indicators, analogous to the health index, might be constructed for the fields of education, mental health, and environmental quality, among others. For example, an index of environmental quality could be constructed, incorporating such variables as the levels of air pollution, water pollution, noise, etc., where the weights for each of these were generated, using a standard gamble technique.

Within the context of the health index itself, it would seem fruitful to undertake further development in terms of time series and cross-sectional analyses. This should be done

the benefits to be derived from any particular project.

It should be noted that, particularly within the context of government program planning, it would be advisable to enlarge the sample of doctors used in generating the weights. The discussion of Table 1 in the Appendix indicates the extent to which the sample size has to be expanded in order to reduce the confidence interval means down to acceptable ranges. The trade-off is between the costs of further interviews and the benefits to be derived from more accurate estimates of the risk weights. In the context of program selection, these benefits manifest themselves in increased ability to clearly determine the relative efficacy of competing programs in reducing the general level of ill health.

APPENDIX

TABLE I

RISK WEIGHTS AND STANDARD DEVIATIONS OF 59 DISEASE STATES

Disease State	Risk Weight (= $\bar{x}$) (1)	Standard Deviation (= $\sigma_{\bar{x}}$)	Coefficient of Variation ($\frac{\sigma_{\bar{x}}}{\bar{x}}$ = V)
1. Leukemia	.7700	.0800	.1038
2. Malignant neoplasm of the trachea	.7241	.1253	.2018
3. Tetanus	.6996	.1235	.1765
4. Muscular dystrophy	.6352	.1342	.2112
5. Cirrhosis	.5340	.1285	.2405
6. *Multiple sclerosis	.4311	.1057	.2450
7. Malignant neoplasm of prostate	.1820	.0111	.0611
8. *Chronic rheumatic heart disease	.1647	.0417	.2533
9. Patent ductus arteriosis	.1570	.1117	.7119
10. *Cerebral haemorrhage	.1366	.0368	.2693
11. *Haemolytic disease of the newborn	.1070	.0740	.6914
12. Polio	.1013	.0414	.4082
13. Hydronephrosis	.0946	.0437	.4621
14. Emphysema	.0844	.0141	.1672
15. *Rheumatoid arthritis	.0843	.0422	.5015
16. Septicaemia	.0834	.0352	.4225
17. *Traumatic amputation of the arm	.0714	.0207	.2900
18. Open wound of eye or ear	.0705	.0372	.5276
19. Prematurity	.0659	.0378	.5734
20. Hypertensive disease	.0652	.0380	.5826
21. Haemorrhage of Pregnancy	.0541	.0372	.6892
22. Meningitis	.0531	.0367	.6919

Disease State	Risk Weight ($= \bar{x}$)	Standard Deviation ($= \sigma_{\bar{x}}$)	Coefficient of Variation ($\frac{\sigma_{\bar{x}}}{\bar{x}} = V$)
23. *Diabetes mellitus	.0513	.0188	.3664
24. *Toxaemia of pregnancy	.0457	.0192	.4192
25. Tuberculosis	.0455	.0163	.3573
26. *Asthma	.0363	.0120	.3241
27. Spina bifida	.0322	.0191	.5926
28. *Peptic ulcer	.0252	.0101	.4023
29. Malpresentation of the foetus	.0184	.0105	.5717
30. Stricture of the urethra	.0183	.0107	.5874
31. Displacement of intervertebral disc	.0181	.0088	.4883
32. Epilepsy	.0171	.0075	.4391
33. *Infectious hepatitis	.0161	.0060	.3763
34. Club foot	.0158	.0097	.6191
35. Fracture of the femur	.0150	.0094	.7160
36. Osteoarthritis	.0144	.0090	.6312
37. *Cleft palate	.0091	.0042	.4648
38. Scarlet fever	.0068	.0058	.8544
39. *Cystitis	.0064	.0050	.7812
40. Uterovaginal prolapse	.0064	.0038	.6000
41. Chronic sinusitis	.0063	.0038	.5968
42. Hernia	.0057	.0034	.6052
43. *Pneumonia	.0055	.0020	.3727
44. Cataract	.0045	.0022	.5045
45. Bursitis	.0039	.0024	.6051
46. Migraine	.0037	.0031	.8297
47. Varicose veins	.0032	.0017	.5281

Disease State	Risk Weight (= $\bar{x}$)	Standard Deviation ($= \sigma_{\bar{x}}$)	Coefficient of Variation ($\frac{\sigma_{\bar{x}}}{\bar{x}} = V$)
48. *Iron deficiency anaemia	.0028	.0021	.7703
49. Choleolithiasis	.0026	.0017	.6653
50. *Haemorrhoids	.0024	.0010	.4291
51. Appendicitis	.0024	.0017	.7208
52. Non-toxic goitre	.0022	.0017	.7818
53. *Fracture of the jaw	.0011	.0002	.1888
54. Benign neoplasm of the breast	.0008	.0004	.4625
55. *Otitis media	.0007	.0002	.3428
56. *Streptoccocal sore throat	.0006	.0002	.4000
57. Pilonidal cyst	.0005	.0001	.2800
58. Influenza	.0005	.0001	.2800
59. *Impetigo	.0001	.00001	.1400

(1) Risk weight is the average risk of death accepted by the sample of doctors to rid themselves of the disease in question.

*
Sample size for starred states equals 10, for all others equals 5.

Scarlet Fever

$\bar{X}$ = sample mean = 68

σ^2_p = population variance = 16860

+ 25% band, 90% level

$1.6\sigma_{\bar{X}}$ = 17

$\sigma_{\bar{X}}$ = 10.6

$\sigma^2_{\bar{X}}$ = variance of sample means = 112

N = required size of sample = 16860/112 = 151

+ 10% band, 90% level

$1.6\sigma_{\bar{X}}$ = 6.8

$\sigma_{\bar{X}}$ = 4.25

$\sigma^2_{\bar{X}}$ = 18

N = 16860/18 = 937

+ 25% band, 95% level

$2\sigma_{\bar{X}}$ = 17

$\sigma_{\bar{X}}$ = 8.5

$\sigma^2_{\bar{X}}$ = 72.25

N = 16860/72.25 = 233

+ 10% band, 95% level

$2\sigma_{\bar{X}}$ = 6.8

$\sigma_{\bar{X}}$ = 3.4

$\sigma^2_{\bar{X}}$ = 11.6

N = 16860/11.6 = 1453

Hemorrhoids

$\bar{X} = 24$ $\qquad \sigma_p^2 = 1070$

+ 25% band, 90% level $\qquad 1.6\sigma_{\bar{X}} = 6$

$$\sigma_{\bar{X}} = 3.75$$

$$\sigma_{\bar{X}}^2 = 14$$

$$N = 1070/14 = 76$$

+ 10% band, 90% level $\qquad 1.6\sigma_{\bar{X}} = 2.4$

$$\sigma_{\bar{X}} = 1.5$$

$$\sigma_{\bar{X}}^2 = 2.25$$

$$N = 1070/2.25 = 476$$

Leukemia $\quad \sigma_{\bar{X}} = 7700 \qquad \sigma_p^2 = 3.2$

$\pm$ 10% band, 90% level $\quad 1.6\sigma_{\bar{X}} = 770$

$$\sigma_{\bar{X}} = 481$$

$$\sigma_{\bar{X}}^2 = 231{,}361$$

$$N = 3{,}200{,}000/231{,}361 = 14$$

TABLE II

DISEASES RANKED BY RISK WEIGHT

Risk Weight Rank	Code No.	Disease State	Risk Weight
1	47	Benign neoplasm of skin	.0001
2	184	*Impetigo	.0001
3	244	Contusion and crushing with intact skin surface	.0001
4	86	Conjunctivitis and opthalmia	.0002
5	120	Hyperthrophy of tonsils and adenoids	.0002
6	122	Deflected nasal septum	.0002
7	160	Redundant prepuse and phimosis	.0002
8	186	Infections of skin and subcutaneous tissue	.0002
9	114	Acute upper respiratory infection, except influenza	.0003
10	167	Malposition of uterus	.0003
11	187	Other inflammatory conditions of skin and subcutaneous tissue	.0003
12	188	Other diseases of skin and subcutaneous tissue	.0003
13	51	Benign neoplasm of male genital organs	.0005
14	115	*Influenza	.0005
15	175	Abortion	.0005
16	185	*Pilonidal cyst	.0005
17	245	Effects of foreign body entering through orifice	.0005
18	128	Diseases of teeth and supporting structures	.0007
19	46	*Benign neoplasm of breast	.0008
20	92	*Otitis media without mention of mastoiditis	.0008
21	123	Other diseases of upper respiratory tract	.0009

Risk Weight Rank	Code No.	Disease State	Risk Weight
22	7	*Streptococcal sore throat, *scarlet fever and erysipelas	.0010
23	16	Other virus diseases	.0010
24	18	Venereal diseases	.0010
25	87	Inflammatory diseases of the eye	.0010
26	91	Other diseases of the eye	.0010
27	117	Bronchitis	.0010
28	162	Diseases of breast	.0010
29	233	Dislocation without fracture, sprains of joints and adjacent muscles	.0010
30	88	Strabismus	.0015
31	164	Infective diseases of cervix uteri	.0015
32	159	Hyperplasia of prostate	.0018
33	57	*Nontoxic goitre	.0020
34	129	Other diseases of oral cavity, salivary glands and jaws	.0020
35	135	Gastritis and duodenitis	.0020
36	163	Diseases of ovary, fallopian tube and parametrium	.0020
37	165	Infective diseases of uterus (except cervix), vagina and vulva	.0020
38	223	Termination of pregnancy	.0020
39	239	Other and unspecified laceration of head and other multiple and unspecified open wounds of head, neck and trunk without mention of complication, with complication and late effect.	
	243	Other lacerations and open wound of head, neck, trunk and limbs	.0020
40	111	*Hemorrhoids	.0024
41	137	*Appendicitis	.0024
42	48	Benign neoplasm of uterus	.0025
43	49	Benign neoplasm of ovary	.0025

Risk Weight Rank	Code No.	Disease State	Risk Weight
44	50	Benign neoplasm of other female genital organs	.0025
45	181	Delivery complicated by prolonged labour or other origin	.0025
46	147	*Choleolithiasis	.0026
47	2,3	Other intestinal infections, diarrhea	.0027
48	65	*Iron deficiency anaemia	.0029
49	94	Other diseases of ear and mastoid process	.0030
50	141	Gastroenteritis and colitis, except ulcerative, of non-infectious origin	.0030
51	168	Disorders of menstruation	.0030
52	172	Other complications of pregnancy	.0030
53	182	Delivery with other complications including anesthetic death in uncomplicated delivery	.0030
54	230	Fracture of upper limb	.0030
55	53	Other benign neoplasms	.0032
56	110	*Varicose veins of lower extremities	.0032
57	1	Salmonella infections	.0035
58	178	Delivery complicated by bony pelvis	.0035
59	179	Delivery complicated by fetopelvic disproportion	.0035
60	14	Viral disease accompanied by exanthem	.0040
61	20	Mycoses, helminthiases and other infective and parasitic diseases	.0040
62	66	Pernicious anaemia and other B_{12} deficiency anaemias	.0040
63	161	Other diseases of male genital organs	.0040
64	195	Synovitis, *bursitis and tenosynovitis	.0040
65	232	Other fractures of lower limbs	.0040
66	250	Other adverse effects (accidents, poisoning and violence)	.0040

Risk Weight Rank	Code No.	Disease State	Risk Weight
67	89	*Cataract	.0045
68	199	Congenital anomalies of eye	.0045
69	62	Avitaminoses and other nutritional deficiency	.0050
70	90	Glaucoma	.0050
71	148	Cholecystitis and cholangitis	.0050
72	209	Congenital anomalies of genito-urinary system	.0050
73	246	Burns	.0050
74	116	*Pneumonia	.0055
75	191	Other arthritis and rheumatism	.0055
76	138	*Hernia without mention of obstruction	.0057
77	13	Asceptic meningitis and other enterovirus diseases of central nervous system	.0060
78	19	Other spirochetal diseases	.0060
79	85	Diseases of nerves and peripheral ganglia	.0060
80	183	Complications of puerperium	.0060
81	194	Other diseases of joint	.0060
82	121	*Chronic sinusitis	.0063
83	15	Arthropod borne viral diseases	.0064
84	155	*Cystitis	.0064
85	166	*Uterovaginal prolapse	.0064
86	12	Late effects of acute poliomyelitis	.0070
87	169	Other diseases of femal genital organs	.0070
88	227, 228	Fracture of jaw, Other fractures of skull and face bones	.0075
89	112	Non-infective disease of lymphatic channels	.0080
90	170	Infection of genital tract during pregnancy and urinary infections during pregnancy and puerperium	.0080
91	196	Other diseases of musculoskeletal system	.0080

Risk Weight Rank	Code No.	Disease State	Risk Weight
92	83	*Migraine	.0090
93	5	Zoonosis	.0100
94	93	Mastoiditis with or without otitis media	.0100
95	113	Other diseases of the circulatory system	.0100
96	126	Pleurisy, spontaneous pneumothorax, chronic pulmonary oedema	.0100
97	130	Diseases of the esophagus	.0100
98	136	Other diseases of stomach and duodenum	.0100
99	143	Diverticula of intestine	.0100
100	200,204, 212	Anomalies of ear, other anomalies of nose, other and unspecified congenital anomalies	.0100
101	205,206, 207	*Cleft palate, cleft lip and cleft palate with cleft lip	.0100
102	216	Maternal ante- and intrapartum infection	.0100
103	226	Fracture of skull	.0100
104	144	Other diseases of intestine and peritoneum	.0120
105	158	Other diseases of urinary system	.0120
106	180	*Delivery complicated by malpresentation of fetus	.0120
107	234	Intracranial injury excluding those with skull fracture	.0120
108	21	Malignant neoplasm of buccal cavity and pharynx	.0150
109	95	Active rheumatic fever	.0150
110	154	Calculus of urinary system	.0150
111	229	Fractures of spine and trunk	.0150
112	231	*Fracture of femur	.0150
113	210	*Clubfoot (congenital)	.0158
114	56	Thyrotoxicosis with or without goitre	.0160
115	190	*Osteoarthritis and allied conditions	.0160
116	17	*Infectious hepatitis	.0161

Risk Weight Rank	Code No.	Disease State	Risk Weight
117	82	*Epilepsy	.0171
118	31	Malignant neoplasm of skin	.0180
119	192	Osteomyelitis and other diseases of bone	.0180
120	193	*Displacement of intervertebral disc	.0181
121	157	*Stricture of urethra	.0184
122	6	Other bacterial diseases	.0200
123	54,55	Carcinoma in situ of cervix uteri Other neoplasms of unspecified nature	.0200
124	58	Other diseases of thyroid gland	.0200
125	139	Hernia with obstruction	.0200
126	152	Infections of kidney	.0200
127	156	Other diseases of bladder	.0200
128	149	Other diseases of gall bladder and biliary ducts	.0200
129	249	Toxic effect of substances chiefly non-medicinal as to source	.0240
130	52	Benign neoplasm of brain and other parts of nervous system	.0250
131	60	Other endocrine diseases	.0250
132	208	Other congenital anomalies of digestive system	.0250
133	248	Adverse effects of medical agents	.0250
134	131	Ulcer of stomach	.0252
135	132	Ulcer of duodenum	.0252
136	133	*Peptic ulcer site unspecified	.0252
137	108	Phlebitis and thrombophlebitis	.0300
138	134	Gastrojejunal ulcer	.0300
139	140	Intestinal obstruction without mention of hernia	.0300
140	211	Congenital anomalies of musculoskeletal system	.0300

Risk Weight Rank	Code No.	Disease State	Risk Weight
141	241	*Traumatic amputation of upper limbs	.0300
142	177	Delivery complicated by: placenta previa or antepartum hemorrhage, retained placenta or other post partum hemorrhage	.0350
143	119	*Asthma	.0363
144	127	Other chronic interstitial pneumonia, bronchiectasis and all other diseases of respiratory system	.0400
145	173	Pre-eclampsia, eclampsia, toxemia-unspecified and hyperemesis grafidarum	.0400
146	251	Complications peculiar to certain surgical and medical procedures	.0400
147	64	Other metabolic diseases	.0450
148	142	Chronic enteritis and ulcerative colitis	.0450
149	214	Other maternal conditions unrelated to pregnancy	.0450
150	217,218 221,222	Birth injury; asphyxia, anoxia, or hypoxia Hemorrhagic disease of the newborn; other causes of perinatal morbidity and mortality	.0450
151	4	*Tuberculosis	.0455
152	215	*Toxemia of pregnancy	.0457
153	150	Diseases of pancreas	.0500
154	174	Renal disease and other toxemias of pregnancy and the puerperium	.0500
155	242	Traumatic amputation of lower limbs	.0500
156	247	Injury to nerves and spinal cord	.0500
157	59	*Diabetes mellitus	.0513
158	171	*Hemorrhage of pregnancy	.0541
159	81	Paralysis agitans	.0600
160	104	Arteriosclerosis	.0650
161	97	*Hypertensive disease	.0652
162	124	Empyema and abscess of lung	.0700

Risk Weight Rank	Code No.	Disease State	Risk Weight
163	220	*Immaturity unspecified (excludes immature newborn)	.0700
164	240	*Open wound of eye or ear	.0705
165	202,203	*Patent ductus arteriosus, coarctation of aorta and other anomalies of aorta	.0750
166	238	Internal injury of chest, abdomen and pelvis	.0750
167	9	*Septicaemia	.0834
168	189	*Rheumatoid arthritis and allied conditions	.0835
169	118	*Emphysema	.0844
170	153	*Hydronephrosis	.0946
171	61	Nutritional marasmus	.1000
172	77	*Meningitis and other inflammatory diseases of the central nervous system	.1000
173	109	Venous embolism and thrombosis	.1000
174	201	Congenital anomalies of heart	.1000
175	213	Chronic circulatory and genitourinary diseases in mother	.1000
176	10	*Poliomyelitis	.1013
177	11	Acute poliomyelitis unspecified	.1013
178	219	*Hemolytic disease of newborn	.1070
179	106	Other diseases of arteries, arterioles and capillaries	.1200
180	125	Pneumoconiosis and related diseases	.1200
181	67	Other diseases of blood and blood-forming organs	.1500
182	84	Other diseases of central nervous system	.1500
183	151	Nephritis and nephrosis	.1500
184	235,236 237	Injury without mention of open intracranial wound; injury with open intracranial wound; Injury - late effects	.1500
185	63	Congenital disorders of metabolism	.1600
186	96	*Chronic rheumatic heart disease	.1647

Risk Weight Rank	Code No.	Disease State	Risk Weight
187	37	Malignant neoplasm of other and unspecified female genital organs	.1800
188	98	Acute myocardial infarction	.1800
189	99	Other ischemic heart disease	.1800
190	38	*Malignant neoplasm of prostate	.1820
191	101	*Cerebral haemorrhage	.1960
192	39	Malignant neoplasm of other and unspecified male genital organs	.2000
193	102	Cerebral embolism and thrombosis	.2000
194	107	Pulmonary embolism and infarction	.2000
195	8	Meningococcal infection and*tetanus	.2500
196	24	Malignant neoplasm of large intestine except rectum	.2500
197	33	Malignant neoplasm of cervix uteri	.2500
198	105	Aortic aneurysm	.2500
199	197	*Spina bifida and congenital hydrocephalus	.2500
200	198	Other congenital anomalies of nervous system	.2500
201	25	Malignant neoplasm of rectum and rectosigmoid junction	.3000
202	32	Malignant neoplasm of breast	.3000
203	40	Malignant neoplasm of bladder	.3000
204	45	Other neoplasms lympathatic and hematopoietic tissue	.3000
205	100	Other forms of heart disease	.3000
206	34	Malignant neoplasm of uterus	.4000
207	35,36	Malignant neoplasm of ovary; malignant neoplasm of fallopian tube and broad ligament	.4000
208	43	Other primary and secondary malignant neoplasms	.4000
209	103	Other cerebrovascular disease	.4000
210	80	*Multiple sclerosis	.4311
211	41	Malignant neoplasm of other and unspecified urinary organs	.5000

Risk Weight Rank	Code No.	Disease State	Risk Weight
212	145	*Cirrhosis of liver	.5340
213	146	Other diseases of liver	.6000
214	22	Malignant neoplasm of stomach	.6200
215	23	Malignant neoplasm of small intestine including duodenum	.6300
216	78	*Muscular dystrophy, chorea and ataxia	.6400
217	79	Other hereditary and familial diseases of nervous system	.7000
218	27,28	*Malignant neoplasm of trachus; Malignant neoplasm of bronchus and lung	.7300
219	29	Malignant neoplasm of other respiratory organs	.7300
220	44	*Leukemia	.7700
221	30	Malignant neoplasm of bone	.7800
222	26	Malignant neoplasm of other digestive organs	.8000
223	42	Malignant neoplasm of brain	.9000
224		Death	1.0000

* Starred states are those whose weights were determined by survey of doctors; all others were interpolated from these 59 starred risk weights.

TABLE III

DISEASES RANKED BY CONTRIBUTION TO ILL-HEALTH INDEX

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
35,36	Malignant neoplasm of ovary Malignant neoplasm of fallopian tube and broad ligament	.4000	0	.0000
214	Other maternal conditions unrelated to pregnancy	.0450	0	.0000
216	Maternal ante and intrapartum infection	.0100	1	.0100
51	Benign neoplasm of male genital organs	.0005	5	.0025
12	Late effects of acute poliomyelitis	.0070	2	.0140
179	Delivery complicated by fetopelvic disproportion	.0035	4	.0140
185	Pilonidal cyst	.0005	30	.0150
167	Malposition of uterus	.0003	55	.0165
178	Delivery complicated by bony pelvis	.0035	6	.0210
13	Asceptic meningitis and other enterovirus diseases of central nervous system	.0060	5	.0300
181	Delivery complicated by prolonged labour or other origin	.0025	14	.0350
122	Deflected nasal septum	.0002	202	.0404
47	Benign neoplasm of skin	.0001	491	.0491
160	Redundant prepuce and phimosis	.0002	335	.0670
223	Termination of pregnancy	.0020	35	.0700

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
46	Benign neoplasm of breast	.0008	107	.0856
5	Zoonosis	.0100	11	.1100
182	Delivery with other complications including an[illegible]thetic death in uncomplicated delivery	.0030	38	.1140
1	Salmonella infections	.0035	35	.1225
199	Congenital anomalies of the eye	.0045	28	.1260
7	Streptococcal sore throat, scarlet fever, and erysipelas	.0010	171	.1710
15	Arthropod borne viral diseases	.0064	28	.1792
133	Peptic ulcer, site unspecified	.0252	8	.2016
184	Impetigo	.0001	2188	.2188
205,206,207	Cleft palate, cleft lip, cleft palate with cleft lip	.0100	26	.2600
180	Delivery complicated by malpresentation of fetus	.0120	29	.3480
2,3	Other intestinal infections, diarrhea	.0027	129	.3483
183	Complications of puerperium	.0060	60	.3600
215	Toxemia of pregnancy	.0457	8	.3656
57	Nontoxic goitre	.0020	178	.3916

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
175	Abortion	.0005	873	.4365
50	Benign neoplasm of other female genital ovaries	.0025	184	.4600
112	Non-infective disease of lymphatic channels	.0080	59	.4720
18	Venereal diseases	.0010	473	.4730
226	Fracture of skull	.0100	48	.4800
172	Other complications of pregnancy	.0030	175	.5250
11	Acute poliomyelitis unspecified	.1013	6	.6078
244	Contusion and crushing with intact skin surface	.0001	6553	.6553
170	Infection of genital tract during pregnancy and urinary infections	.0080	97	.7760
245	Effects of foreign body entering through orifice	.0005	1573	.7865
91	Other diseases of the eye	.0010	790	.7900
19	Other spirochetal diseases	.0060	134	.8050
120	Hypertrophy of tonsils and adenoids	.0002	4409	.8818
250	Other adverse effects	.0040	224	.8960
174	Renal disease and other toxemias	.0500	21	1.050

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
220	Immaturity unspecified (excludes immature 'newborn')	.0700	15	1.050
86	Conjunctives and ophthalmia	.0002	5281	1.056
10	Poliomyelitis	.1013	11	1.114
61	Nutritional marasmus	.1000	12	1.200
159	Hyperplasia of prostate	.0018	695	1.250
177	Delivery complicated by: placenta previa or antepartum hemorrhage, retained placenta or other post partum hemorrhage	.0350	42	1.470
162	Diseases of breast	.0010	1485	1.485
125	Pneumoconiosis and related diseases	.1200	13	1.560
209	Congenital anomalies of genito-urinary system	.0050	315	1.570
31	Malignant neoplasm of skin	.0180	93	1.674
49	Benign neoplasm of ovary	.0025	679	1.697
163	Diseases of the ovary, fallopian tube and parametrium	.0020	876	1.752
153	Hydronephrosis	.0946	21	1.990
21	Malignant neoplasm of buccal cavity and pharynx	.0150	139	2.085

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
79	Other hereditary and familiar diseases of nervous system	.7000	3	2.100
128	Diseases of teeth and supporting structures	.0007	3121	2.185
52	Benign neoplasm of brain and other parts of nervous system	.0250	93	2.320
93	Mastoiditis with or without otitis media	.0100	243	2.430
124	Emphysema and abscess of lung	.0700	35	2.450
88	Strabismus	.0015	1643	2.460
210	Clubfoot (congenital)	.0158	157	2.480
219	Hemolytic disease of the newborn	.1070	25	2.670
137	Appendicitis	.0024	1135	2.720
241	Traumatic amputation of upper limbs	.0300	98	2.940
87	Inflammatory diseases of the eye	.0010	3029	3.029
227, 228	Fracture of the jaw Other fractures of skull and face bone	.0075	418	3.135
48	Benign neoplasm of uterus	.0025	1264	3.160
186	Infections of skin and subcutaneous tissue	.0002	16368	3.270
130	Diseases of esophagus	.0100	334	3.340
208	Other congenital anomalies of digestive system	.0250	134	3.350
95	Active rheumatic fever	.0150	232	3.480

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
139	Hernia with obstruction	.0200	178	3.560
129	Other diseases of oral cavity, salivary glands and jaws	.0020	1797	3.590
4	Tuberculosis	.0455	82	3.731
213	Chronic circulatory and genitourinary diseases in mother	.1000	38	3.800
131	Ulcer of stomach	.0252	163	4.100
109	Venous embolism and thrombosis	.1000	42	4.200
156	Other diseases of bladder	.0200	220	4.400
201	Congenital anamolies of heart	.1000	46	4.600
53	Other benign neoplasms	.0032	1440	4.608
242	Traumatic amputation of lower limbs	.0500	94	4.700
62	Avitaminoses and other nutritional deficiencies	.0050	983	4.915
147	Choleolithiasis	.0026	1917	4.980
39	Malignant neoplasm of other and unspecified male genital organs	.2000	26	5.200
232	Other fractures of lower limbs	.0040	1357	5.430
173	Pre-eclampsia, eclampsia, toxemia-unspecified and hyperemesis grafidarum	.0400	139	5.560
166	Uterovaginal prolapse	.0064	887	5.670

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
149	Other diseases of gallbladder and bilary ducts	.0220	263	5.780
234	Intracranial injury excluding those with skull fracture	.0120	489	5.870
113	Other diseases of the circulatory system	.0100	604	6.040
247	Injury to nerves and spinal column	.0540	121	6.050
200,204 212	Anomalies of ear. Other anomalies of nose. Other and unspecified congenital anomalies	.1000	618	6.180
111	Hemorrhoids	.0024	2727	6.544
235,236 237	Injury without mention of open intracranial wound. Injury with open intracranial wound. Injury-late effects	.1500	45	6.750
6	Other bacterial diseases	.0200	348	6.960
164	Infective diseases of cervix uteri	.0015	4653	6.980
188	Other diseases of skin and subcutaneous tissue	.0003	23339	7.000
246	Burns	.0050	1406	7.030
187	Other inflammatory conditions of skin and subcutaneous tissue	.0003	24517	7.350
154	Calculus of urinary system	.0150	515	7.720
115	Influenza	.0005	15466	7.733

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
110	Varicose veins of lower extremities	.0032	2516	8.050
126	Pleurisy, spontaneous pneumothorax, chronic pulmonary oedema	.0100	883	8.830
248	Adverse effects of medical agents	.0250	390	9.750
20	Mycoses, helminthiases and other infective and parasitic diseases	.0040	2473	9.890
101	Cerebral hemorrhage	.1960	51	9.996
230	Fracture of upper limb	.0030	3418	10.25
143	Diverticula of intestine	.0100	1078	10.78
202 203	Patent ductus arteriosus, coarctation of aorta and other anomalies of circulatory system. Other congenital anomalies of circulatory system	.0750	154	11.55
251	Complications peculiar to certain surgical and medical procedures	.0400	293	11.72
16	Other virus diseases	.0010	11759	11.75
148	Cholecystitis and cholangitis without mention of calculus	.0050	2508	12.54
171	Hemorrhage of pregnancy	.0541	232	12.55

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
92	Otitis media without mention of mastoiditis	.0008	15774	12.62
9	Septicemia	.0834	152	12.68
14	Viral disease accompanied by exanthem	.0040	3263	13.05
249	Toxic effect of substances chiefly non-medicinal as to source	.0240	557	13.36
157	Stricture of urethra	.0184	735	13.52
142	Chronic enteritis and ulcerative colitis	.0450	306	13.77
135	Gastritis and duodenitis	.0020	6902	13.80
229	Fractures of spine and trunk	.0150	928	13.92
231	Fracture of femur	.0150	936	14.04
161	Other diseases of male genital organs	.0040	3543	14.17
90	Glaucoma	.0050	2873	14.36
238	Internal injury of chest, abdomen and pelvis	.0750	219	16.42
211	Congenital anomalies of musculoskeletal system	.0300	554	16.62
233	Dislocation without fracture, sprains of joints and adjoining muscles	.0010	16746	16.75
37	Malignant neoplasm of other and unspecified female genital organs	.1800	95	17.10

QHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
89	Cataract	.0045	3868	17.40
83	Migraine, other diseases of brain and motor neurone disease	.0090	1935	17.41
194	Other diseases of joint	.0060	2939	17.63
150	Diseases of pancreas	.0500	358	17.90
196	Other diseases of musculoskeletal system	.0080	2328	18.62
165	Infective diseases of uterus (except cervix), vagina and vulva	.0020	9390	18.78
17	Infectious hepatitis	.0161	1194	19.22
65	Iron deficiency anemia	.0029	7173	20.80
197	Spina bifida and congenital hydrocephalus	.2500	86	21.50
140	Intestinal obstruction without mention of hernia	.0300	758	22.74
116	Pneumonia	.0055	4270	23.48
192	Osteomyelitis and other diseases of bone	.0180	1324	23.80
114	Acute upper respiratory infection, except influenza	.0003	85574	25.67
56	Thyrotoxicosis with or without goitre	.0160	1695	25.68
141	Gastroenteritis and colitis, except ulcerative, or non-infectious origin	.0030	8716	26.15

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
195	Synovitis, bursitis and tenosynovitis	.0040	6541	26.16
117	Bronchitis	.0010	26854	26.85
136	Other diseases of stomach and duodenum	.0100	2712	27.12
138	Hernia without mention of obstruction	.0057	4779	27.24
8	Meningococcal infection and tetanus	.2500	110	27.50
105	Aortic aneursym	.2500	116	29.00
121	Chronic sinusitis	.0063	4769	30.04
41	Malignant neoplasm of other and unspecified urinary organs	.5000	61	30.50
94	Other diseases of ear and mastoid process	.0030	10257	30.77
134	Gastrojejunal ulcer	.0300	1048	31.44
217,218, 221,222	Birth injury; asphyxia, anoxia or hypoxia; hemorrhagic disease of newborn; other causes of perinatal morbidity and mortality	.0450	709	31.90
198	Other congenital anomalies of nervous system	.2500	129	32.25
33	Malignant neoplasm of cervix uteri	.2500	130	32.50
77	Meningitis and other inflammatory disease of the central nervous system	.1000	329	32.90

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
66	Pernicious anaemia and other B12 deficiency anaemias	.0040	8230	32.92
58	Other diseases of thyroid gland	.0200	1764	35.28
82	Epilepsy	.0171	2174	37.17
240	Open wound of eye or ear	.0750	551	38.84
239, 243	Other and unspecified laceration of head and other multiple and unspecified open wounds of head, neck and trunk without mention of complication, with complication and late effect. Other lacerations and open wound of head, neck, trunk and limbs	.0020	19544	39.08
30	Malignant neoplasm of bone	.7800	49	39.22
152	Infection of kidney	.0200	2033	40.66
107	Pulmonary embolism and infarction	.2000	207	41.40
63	Congenital disorders of metabolism	.1600	266	42.56
123	Other diseases of the upper respiratory tract	.0009	47955	43.16
23	Malignant neoplasm of small intestine including duodenum	.6300	73	45.99
24	Malignant neoplasm of large intestine except rectum	.2500	184	46.00
144	Other diseases of intestines and peritoneum	.0120	4199	50.39
168	Disorders of menstruation	.0030	17564	52.69
42	Malignant neoplasm of brain	.9000	60	54.00

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
108	Phlebitis and thrombophlebitis	.0300	1801	54.03
38	Malignant neoplasm of prostate	.1820	298	54.24
85	Diseases of the nerves and peripheral ganglia	.0060	9350	56.10
155	Cystitis	.0064	9400	60.16
34	Malignant neoplasm of uterus	.4000	167	66.80
158	Other diseases of urinary system	.0120	5693	68.31
40	Malignant neoplasm of bladder	.3000	231	69.30
25	Malignant neoplasm of rectum and rectosigmoid junction	.3000	236	70.80
106	Other diseases of arteries, arterioles and capillaries	.1200	595	71.40
169	Other diseases of female genital organs	.0070	10274	71.90
22	Malignant neoplasm of stomach	.6200	116	71.92
54,55	Carcinoma in situ of cervix uteri, other neoplasms of unspecified nature	.0200	3696	73.92
127	Other chronic interstitial pneumonia, bronchiectasis and all other diseases of respiratory system	.0400	1871	74.84
78	Muscular dystrophy, chorea and ataxia	.6400	117	74.88

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
102	Cerebral embolism and thrombosis	.2000	413	82.60
81	Paralysis agitans	.0600	1392	83.52
191	Other arthritis and rheumatism	.0055	16541	90.97
29	Malignant neoplasm of respiratory organs	.7300	130	94.90
96	Chronic rheumatic heart disease	.1647	739	121.7
193	Displacement of intervertebral disc	.0181	7189	130.1
26	Malignant neoplasm of other digestive organs	.8000	165	132.0
190	Osteoarthritis and allied conditions	.0160	9454	151.2
118	Emphysema	.0844	1817	153.4
132	Ulcer of duodenum	.0252	6156	155.1
45	Other neoplasms lymphatic and hematopoietic tissue	.3000	575	172.5
67	Other diseases of blood and blood-forming organs	.1500	1257	188.5
151	Nephritis and nephrosis	.1500	1280	192.0
146	Other diseases of liver	.6000	320	192.0
32	Malignant neoplasm of breast	.3000	678	203.4
84	Other diseases of central nervous system	.1500	1603	240.4

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
97	Hypertensive disease	.0652	50701	3305.
100	Other form of heart disease	.3000	25817	7745.
	Ill Health			26,441.5
	Deaths	1.0000	2344	2,344
	Total Ill Health ($=\sum b_iY_i$)			28,785.5

Population at Risk (=POP) 3,942,115

H.I. $=\sum b_iY_i$ / POP = .0073

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill-Health Index ($=b_iY_i$)
98	Acute myocardial infarcation	.1800	1355	243.9
44	Leukemia	.7700	348	268.0
80	Multiple sclerosis	.4311	669	288.4
43	Other primary and secondary malignant neoplasms	.4000	724	289.6
119	Asthma	.0363	8061	292.6
145	Cirrhosis of the liver	.5340	671	358.3
27, 28	Malignant neoplasm of trachea Malignant neoplasm of bronchus and lung	.7300	546	398.6
104	Arteriosclerosis	.0650	7288	512.7
64	Other metabolic diseases	.0450	13180	593.1
60	Other endocrine diseases	.0250	27890	697.2
189	Rheumatoid arthritis and allied conditions	.0835	8991	750.8
59	Diabetes mellitus	.0513	18069	926.9
103	Other cerebrovascular disease	.4000	3806	1522.
99	Other ischemic heart disease	.1800	16452	2961.

TABLE IV

DISEASES WHICH CONTRIBUTE MOST TO ILL HEALTH BY RISK WEIGHT, INCIDENCE AND CONTRIBUTION TO ILL-HEALTH INDEX

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill Health Index ($=b_iY_i$)	% Contribution to Ill Health Index	Cumulative % Contribution to Ill Health Index
100	Other forms of heart disease	.3000	25,817	7745.	26.9	26.9
97	Hypertensive disease	.0652	50,701	3305.	11.5	38.4
99	Other ischemic heart disease	.1800	16,452	2961.	10.3	48.7
	Death	1.0000	2,344	2344.	8.1	56.8
103	Other cerebrovascular disease	.4000	3,806	1522.	5.3	62.1
59	Diabetes mellitus	.0513	18,069	926.9	3.2	65.3
189	Rheumatoid arthritis & allied conditions	.0835	8,991	750.8	2.6	67.9
60	Other endocrine diseases	.0250	27,890	697.2	2.4	70.3

OHIP Code No.	Disease State	Risk Weight ($=b_i$)	Incidence ($=Y_i$)	Contribution to Ill Health Index ($=b_iY_i$)	% Contribution to Ill Health Index	Cumulative % Contribution to Ill Health Index
64	Other metabolic diseases	.0450	13,180	593.1	2.1	72.4
104	Arteriosclerosis	.0650	7,888	512.7	1.8	74.2
27 28	Malignant neoplasm of trachea Malignant neoplasm of bronchus & lungs	.7300	546	398.6	1.4	75.6
145	Cirrhosis of the liver	.5340	671	358.3	1.2	76.8
119	Asthma	.0363	8,061	292.6	1.0	77.8
43	Other primary and secondary malignant neoplasms	.4000	724	289.6	1.0	78.8
80	Multiple sclerosis	.4311	669	288.4	1.0	79.8
44	Leukemia	.7700	348	268.0	.9	80.7
98	Acute myocardial infarcation	.1800	1,355	243.9	.8	81.5
84	Other disease of the central nervous system	.1500	1,603	240.4	.8	82.3
	Total Ill Health ($=\sum b_iY_i$)			28,785.5		